International Maize and Wheat Improvement Center
Sustainable Intensification of maize-legume Systems in Eastern Province of Zambia

Proposal - 2013/2014

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The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment.

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PROPOSAL AMENDMENT

PREAMBLE

This amended proposal is written to document the agreements reached in Salima, Malawi, on 06-07/09/2013, between the Sustainable Intensification of maize-legume Systems in Eastern Province of Zambia (SIMLEZA) project team and members of the Africa Research in Sustainable Intensification for the Next Generation (AFRICA RISING) East and Southern Africa project . It was agreed that SIMLEZA and AFRICA RISING will establish a strategic alliance in the Eastern Province of Zambia and that both parties will commit to this process in full partnership. This new partnership will henceforth be called SIMLEZA-AFRICA RISING (in short SIMLEZA-AR). An amendment to the existing SIMLEZA proposal is necessary to outline activities under SIMLEZA that will be funded through AR. As agreed during the meeting the amendment is built on the SIMLEZA project and is fully aligned with its original proposal. This amendment only covers areas where AR will contribute funds to ongoing SIMLEZA activities and new SIMLEZA-AR activities. Other SIMLEZA activities covered by funds from the Zambia USAID Mission only will feature in the main proposal.

ADMINISTRATIVE DETAILS

Project Title:	Sustainable Intensification of maize-legume Systems in Eastern Province of Zambia – Africa RISING
Grant Agency:	Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) - East and Southern Africa Project-IITA
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Country:	Zambia
Principal Investigator:	Dr. Peter Setimela Senior Scientist
Implementing Partners: National Agricultural Research System, Universities and other Research Organizations	CIMMYT, ZARI, GART,IITA, IFPRI, WUR, MSU
Development Partners:	TLC
Period of activity:	October 2013 to September 2014
Amount requested:	350,000 USD for the whole project amendment

Name	Gender	Institution	Job title	Disciplinary expertise	Degree	Project role/responsibility	% time commitment
Peter S. Setimela	M	CIMMYT	Senior Scientist	Seed system specialist	PhD	Project coordinator and seed systems	20%
Christian Thierfelder	M	CIMMYT	Scientist	Cropping Systems Agronomist	PhD	Lead the cropping system research	10%
Walter Mupangwa	M	CIMMYT	Associate Scientist	Cropping Systems Agronomist	PhD	Designing the cropping system and agronomy research	40%
Jens Andersson	M	CIMMYT	Senior Scientist	Innovation System Scientist	PhD	Research on innovation systems	10%
Munyaradzi Mutenje	F	CIMMYT	Associate Scientist	Socio Economist	PhD	Enhancing technology targeting delivery	10%
Julius Manda	M	IITA	Associate Professional Officer	Agricultural Economist	MSc	Socioeconomic analysis and impact evaluation	100%
Arega Alene	M	IITA	Scientist	Agricultural Economist	PhD	Socioeconomic analysis and impact evaluation	10%
Hesham Agrama	M	IITA	Scientist	Soybean Breeder	PhD	Develop high-yielding and stress-tolerant soybean and cowpea varieties	10%
Setgn Gebeyehu	M	IITA	Scientist	Agronomist	PhD	Design the cropping system/agronomy and seed system (legume component)	100%
Mateete Bekunda	M	IITA	AR Chief Scientist	Soil scientist	PhD	Overall supervision of AR funded activities	5%
Jeroen Groot	M	WUR	Assistant Professor	Farming systems	PhD	Lead farming systems analysis	10%

DESCRIPTION OF WORK PACKAGES

Work package 1.

Work package number	**WP 1**	**Start date or starting event:**		**November 2013 to September 2014**
Work package title	To enhance technology targeting and delivery for the poor by identifying systemic constraints and options for improving input and output value chains and impact pathways			
Activity Type	Identifying key biophysical and socio-economic constraints that limit crop production at farm level			
Target areas (Districts- Villages	Katete	Chipata	Lundazi	
WP leader	CIMMYT/IITA			
Partners	GART	MAL		ZARI, IFPRI, WU
WP budget (USD)	CIMMYT: 35,000 IITA: 20,000 WUR: 70,000 (farming systems and trade-off analysis)			

Relevant Africa RISING Research Output: 1. Situation Analysis (Biophysical characterization)

Key intervention areas: Socio-economic and geo-spatial characterization of selected maize-legume farming areas and selection of research sites/communities

On-going SIMLEZA activities

1.1 Analysis of maize-legume value chains to identify constraints, investment opportunities, and institutional innovations for increased adoption of improved technologies (seed, ISFM including conservation tillage, etc.)

1.2 Socioeconomic analysis of on-farm trials to evaluate the profitability of alternative cropping systems

1.3 Monitoring the adoption of technologies (varieties, conservation agriculture/agronomic practices, & post-harvest) promoted by SIMLEZA

1.4 Early adoption and impact studies of improved maize and legumes varieties and ISFM technologies and define strategies for scaling up/out pro-poor innovations for greater impact on food security.

New SIMLEZA- AR activities

1.5 Farming systems and site characterization in joint intervention sites of Eastern Zambia to improve targeting of interventions (WUR)

1.6 Fulfil joint M and E requirements (IFPRI)

Description of work

1.1 Maize-legume value chains

A value chains approach will be adopted to promote and sustain the adoption of improved technologies through increased output marketing and demand creation for maize and legumes. After a market survey of processors, traders, and other actors along the maize-legume value chains in eastern province, strategic alliances that will link producers to traders and processors will be established. Value chains development will involve activities that lead to increased farm gate prices for producers as well as lower prices and diversify uses maize

and legumes for consumers

1.2 Socioeconomic analysis of on-farm trials to evaluate the profitability of alternative cropping systems

Gross margin and dominance analysis will be conducted using on-farm trial data to provide a guide on the relative profitability and importance of various cropping systems. Data will be collected using specially designed data sheets to capture agronomic data as well costs of input and outputs. This will provide a guide on which treatments merit further investigation and on the recommendations to make to farmers with regards to the most profitable cropping system.

1.3 Monitoring adoption of maize-legume technologies in the project areas and beyond

An Adoption monitoring study will be conducted to assess the number of farmers who are aware of SIMLEZA technologies and who are adopting technologies promoted by SIMLEZA, major sources of technology information, technologies preferred by farmers and the major constraints to adoption of technologies/practices. The survey will specifically target farmers who are aware of SIMLEZA technologies, including farmers who are hosting SIMLEZA demonstrations and trials.

1.4 Early adoption and impact studies

Early adoption and impact studies will be conducted to assess the extent, pathways, and determinants of technology adoption as well as the farm level or primary impacts of technologies among adopters in the target sites where there is significant early adoption. Research hypotheses will be formulated to test and explain gender differentials in adoption and impacts with a view to enhancing the intra-household distribution of the benefits from the project.

1.5 Farming systems analysis

The farming systems analysis will work around the following framework, with specific activities highlighted in the grey boxed (Figure 1). In summary, the process starts with a rapid farming system characterization exercise allowing the development of functional farm typologies, and a detailed characterization farming system description, allowing complete farming system diagnosis. This information would then be synthesized and analysed toward the exploration of system innovations and system redesign.

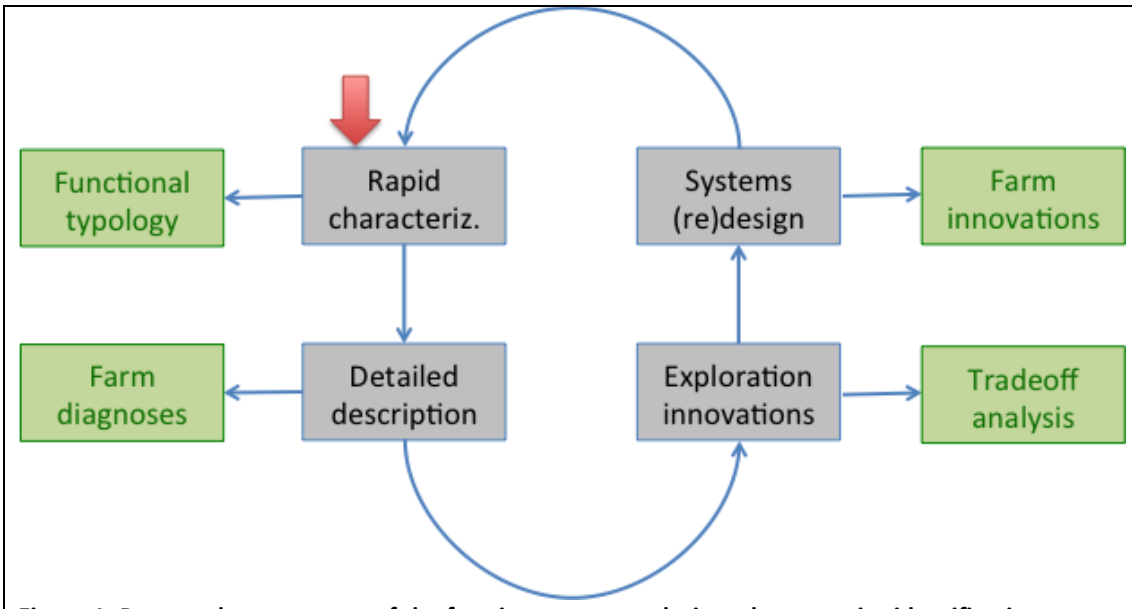

Figure 1: Proposed components of the farming system analysis and entry point identification strategy. Phases in the analysis represented by grey boxes, products indicated in green boxes. Starting point of the analysis indicated with the red arrow.

Step 1. The **rapid characterization** will build on the previously conducted RALS survey. Additional information of households to be collected would focus in particular on:

- Labour availability and use for crop and animal production activities.
- Animal management and feeding.
- Manure management and use.
- Organic inputs such as (purchased) feeds and other resources for instance from roadsides and common areas.

A first appraisal will be made of the farm components present (soil, crops, livestock, etc.), to arrive at first model-based estimates of nutrient flows, labour use, profitability and efficiencies. Such information will allow the construction of functional typologies, e.g., more directly related to production objectives.

Step 2. A sub-set of the households engaged in the rapid characterization activity will be identified for detailed characterization of their farm and livelihood status. More detailed data on actual production levels, costs and prices will result in accurate **diagnosis** of resource flows and socio-economic performance. Such information will allow the diagnosis of the main factors driving the generation of outputs at farm level.

Step 3. A model-based **exploration** of alternative farm configurations will be made for each selected farm. Based on current inputs and production activities (cropping, animals, manure use, etc.) and potential innovative practices, a set of alternatives will be generated using a multi-objectives optimization technique. This will provide insight into tradeoffs and synergies among farm objectives, and will inform discussions with farmers and other stakeholders towards selection and implementation of an improved farm set-up.

Step 4. The **redesign** is based on the set of alternatives generated the previous step and discussions with farmers and stakeholders. The most promising alternative in terms of productivity, profitability and efficiency will be selected. This represents a new farm set-up that needs to be further fine-tuned for implementation on farms of the same the functional type (see II.2). The performance of the new farm set-up will be monitored and new cycles of diagnosis – exploration – redesign can be conducted to reach an adaptive farm improvement.

Deliverables

1. Report on maize-legume value chains with emphasis on key service delivery systems (seed, fertilizer, credit, etc.) and product markets (Activity 1.1)
2. Report on the profitability of alternative cropping systems in eastern Zambia (Activity 1.2)
3. Report on farmer preferences, awareness and extent of adoption of maize-legume technologies, farm and higher level constraints to adoption of maize-legume technologies, and opportunities for different categories of farmers (Activity 1.3)
4. Report on the early adoption and impacts of maize-legume technologies in Eastern Zambia (Activity 1.4)
5. Report on the types of farms and their performance in terms of nutrient flows, labour use, profitability and efficiencies. Initial assessment of trade-offs and synergies among performance indicators, and suggestions for reconfiguration of farming systems of different functional types (from Activity 1.5)

Work package 2.

Work package number	WP 2	Start date or starting event:	November 2013 to September 2014
Work package title	Enhance adoption and adaptation of productive and resilient agronomic practices and facilitation of local innovation systems for intensification and income growth in maize-legume cropping systems		
Activity Type	Action research type, R&T, participatory and promotional action		
Target areas (Districts-Villages	Katete	Chipata	Lundazi
WP leader	CIMMYT and IITA		
Partners	TLC and MAL	WUR	ZARI
WP budget (USD)	CIMMYT: 88,000 IITA: 25,000		

Relevant Africa RISING Research Output: 2. Integrated systems improvement
Key intervention areas: Establishment of on-farm and on-station research addressing critical production constraints and sustainable intensification needs for smallholder farmers in maize-legume cropping systems

Ongoing SIMLEZA activities

2.1 Conduct discussions with innovation platform partners to identify agronomic and seed technologies to be tested on-farm in each of the targeted communities

2.2 Establish on-farm validation trials of maize-legume rotations and integrated innovations to identify improved germ plasm and conservation agriculture technologies that increase productivity and incomes from maize-legume systems

2.3 Evaluate crop production technologies (varieties, agronomic practices) for adaptation and adoption in the targeted agro-ecologies

2.4 Facilitate improved linkages between farmers and input suppliers for timely access to seeds, fertilizers and agrochemicals

2.5 Identify constraints of soybean and cowpea production in target communities by focus group discussions during the season to identify soybean production constraints

New SIMLEZA-AR activities

2.6 Introduce double-up legume systems to test effective combination of agronomic practices

2.7 Trade-off analysis for CA based technologies in context of farm households and practices

2.8 Participatory identification of technology adoption constrains and opportunities at farm and higher (institutional) level with innovation platform members

Description of work

- The project will facilitate the establishment multi-stakeholder interaction mechanisms (innovation platforms) that (1) serve as a feedback mechanism in participatory (on-farm) technology development and adaptation (2.1 and 2.3), and (2) bring together and strengthen interaction between key stakeholders in technology delivery and market functioning (2.4). Initial work in Chipata camps will be strengthened and new work in Lundazi initiated.

- The work in seven target community will be continued and at least six farmers in each community will host CA trials and demonstrations and another six farmers soybean and cowpea agronomy trials. Farming households will be clustered in a radius that allows other farmers to visit the demonstration sites (e.g. sites within 1-2 km from each other). Individual farmers will be regarded as replicates of a trial in each community and the performance of different manual and animal traction systems will be tested. The CA validation and legume agronomy trials will be set up in the November-December 2013 period and, will be monitored and data collected by Extension Agents during 2013/14 season. During the 2013/14 season farmers from each target community will qualitatively evaluate the performance of each technology showcased on the research sites at three growth stages of the maize and legume crops. Farmers and extension officers will be trained through hands-on training on how to do basic agronomy operations, how to apply inoculum on legumes, how to control weeds with herbicides, how to operate different machinery, and how to harvest trials at scientific standards

- Besides on-farm trials a series of component on-station trials will be continued and supported at Msekera Research station. These will include trials on weed control strategies and residue level trials. New trials involving green manure cover crops will be designed and established. Soybean and cowpea agronomy trials will be continued at Msekera station evaluating different options of fertilization, inoculation and combinations of both. A long-term trial on CA will be continued at Msekera station and the effects of minimum soil disturbance, residue retention and crop rotations on water- and nutrient-use-efficiency will be analyzed involving students.

New SIMLEZA-AR activities

2.5. Double up legume systems will be newly introduced into the research program exploring the opportunities of planting different legume species together. This will involve sole stands of cowpea, groundnuts and pigeon pea and different combinations of groundnuts and cowpea intercropped with pigeon pea. The trials will be carried out at Msekera station and, if suitable sites are found, also on-farm.

2.6. A trade-off analysis will be initiated using data from the on-farm demonstration sites. This will be in close collaboration with Work Package 1 to analyze the trade-offs of CA-based technologies on farm household and decision making. Results from the Innovation Platforms will further contribute to the outputs of this activity.

2.7. Innovation platforms will now also be used as fora for the identification and understanding of farm and higher level institutional constraints to, and opportunities for the adoption of the project's technologies (improved germplasm and agronomic practices) for different types of farmers (building on, and in collaboration with 1.2 and 1.4).

Deliverables

1. Innovation platform progress reports
2. At least 56 on-farm CA and 56 legume agronomic validation trials established in seven selected target communities of Eastern Province.
3. Four component on-station trials established and run during 2013/14 season.
4. At least four improved technologies identified for accelerated out scaling
5. Evaluation report of capacity building of farmers and extension agents
6. Train at least 15 extension officers during the 2013/14 cropping season.
7. Report of the performance of different maize-legume combinations under CA systems
8. Report on the performance of double-up legumes
9. Analysis report from the trade-off analysis
10. Draft peer-reviewed publication on nutrient and water use efficiency in selected cropping systems

Work package 3.

Work package number	WP 3	Start date or starting event:		November 2013 to September 2014		
Work package title	Enhance the diversification of soybean use at household level through processing and product development					
Activity Type	Action research, capacity building for farmers and extension staff					
Target areas (Districts-Villages	Katete	Chipata	Lundazi			
WP leader	IITA					
Partners	GART	UNZA		ZARI		
WP budget (USD)	IITA: 26,000					

Ongoing SIMLEZA activity

3.1 Assess the nutritional status and diet quality of women of child bearing age and their under 5 children in target communities

3.2. Adapt and promote household level technologies for the production, processing, and storage of soybean food products.

New SIMLEZA-AR activity

None

Description of work

- Diagnostic studies undertaken under Objective 1 will also provide an understanding of the processing, value addition and diversification needs in project communities. Surveys supplemented by biochemical analyses will be used to assess the nutritional value of existing maize based foods. Anthropometrical, clinical and biochemical analyses will be used to assess the nutritional status of women and children in project communities.

- Processing using low-cost machinery and processes for producing high quality nutritious food products under rural conditions will be tested using participatory approaches. Storage and packaging technologies to extend shelf life of soybean products will also be tested. Smallholder farmers in project locations will be given assistance through training in testing and adopting recommended technologies for processing or product development.

- Nutrition awareness campaigns will be carried out in partnership with all stakeholders involved in technology transfer activities in objective 2. This will involve demonstrations of food products during farmer field days or community level food fairs. The mass media will be used to transfer simplified information on the nutritional benefits of soybean based diets. Primary and secondary school teachers will be sensitized to disseminate the message in schools. Women groups and women opinion leaders will be involved in the overall process.

Deliverables

1. At least four nutrition messages adapted or designed
2. Nutrition seminars combined with food demonstrations and 30 two-days training on soybean utilization conducted
3. At least 10 soybean food products adapted, tested, and introduced in target communities
4. Soybean recipe book translated into 2 major local languages
5. At least two processing technologies introduced/ improved in project sites
6. Three soybean storage methods developed and tested

Work package 4.

Work package number	WP 4	Start date or starting event:		November 2013 to September 2014		
Work package title	Increase the range of maize and legume varieties through participatory testing and release, and enhanced delivery of seeds of locally adapted varieties					
Activity Type	Action research, capacity building for farmers and extension staff					
Target areas (Districts- Villages	Katete	Chipata	Lundazi			
WP leader	CIMMYT/IITA					
Partners	GART	MAL		ZARI		
WP budget (USD)	CIMMYT: 40,000 IITA: 25,000					

Relevant Africa RISING Research Output: 2. Integrated system improvement
Key intervention areas: Introduce and evaluate improved maize and grain legume varieties to small holders farmers to improve productivity and food security

Ongoing SIMLEZA activity

3.1 Conduct on farm trials to identify stress tolerant and higher yielding maize and legume varieties through farmer- and seed company-participatory evaluation and G X E analysis

New SIMLEZA- AR activity

3.2 Explore new legumes in variety trials (e.g. groundnuts, pigeon pea) and other species

Description of work

- **Community mobilization and consultation**. This activity will be to select farmers to host the on-farm variety trials. The community and the extension officers will conduct the community awareness meeting to sensitize farmers and the other members of the community about the project.

- **Farmer and site selection**. Farmers willing to host the trials in each camp and district will be selected for the sensitization meeting in collaboration with extension officers, local leaders and NGOs in each target community.

- **Maize farmer-participatory variety testing**: Mother-Baby Trials are sets of experiments grown with farming communities. They evaluate the performance and acceptance of new varieties under "real" farmer conditions, and create an understandable, cost-effective and simple flow of information between researchers, extension staff and farmers, thus integrating both technical and social aspects in the sense that the users/ultimate beneficiaries are part of the development and transfer of the technology.

This provides for quick and high adoption of new varieties even in a resource-poor environment. Farmer-participatory variety evaluations of legume varieties will be conducted in representative communities using the Mother Baby Trial (MBT) approach. These will be undertaken widely through partnerships with several NGO's, extension and farmer groups in target
Deliverables 1. At least four drought tolerant maize varieties identified and released 2. At least four new legume species identified 3. On-farm and on-station trials established

Work package 5.

Work package number	**WP 5**	**Start date or starting event:**		November 2013 to September 2014		
Work package title	Enhance the capacity of national partners on targeting, technology adaptation, trial management, seed and input supply and value chain development					
Activity Type						
Target areas (Districts- Villages	Katete	Chipata	Lundazi			
WP leader	CIMMYT/IITA					
Partners	UNZA					
WP budget (USD)	CIMMYT: 12,000 US IITA: 9,000					

Relevant Africa RISING Research Output: 3 Scaling and delivery

Key intervention areas:

1. Capacity building for graduate students from the University of Zambia

New SIMLEZA-AR activity

4.1 Train M.Sc. and non-degree students in technology targeting, analysis of value chains, breeding/seed technology, agronomy and cropping systems

4.2 Short term training of partners on-cropping systems and trial management.

Description of work

- Two students from the University of Zambia will be incorporated into the research program. The first student will focus his studies on the "Evaluation of Conservation Agriculture systems effects on the fertility status of the Agricultural soils in Chipata District, Zambia". The second on the "Effects of Conservation Agriculture (CA) techniques on selected soil physical properties"
- **Two students will focus their work on legume agronomy. One will focus his studies on "**Genotype by Environment Interaction and Stability for Seed Quality in Soybean (*Glycine max* L. Merril)". The second on "Genotype x Environment interaction and stability analysis for yield and its components in soybean [*Glycine max.* L. Merril]"

Deliverables

1. At least four master students are trained at the University of Zambia, two on soybean agronomy and two on conservation agriculture systems
2. Draft theses ready by June/July 2014